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Checking damage to Douglas-fir trees.

WHAT IS BEING DONE?

1. Surveys — Due to the importance of spruce budworm infestations, an intensive aerial survey is made each year to determine the extent and severity of the infestations. Aerial surveys are followed by ground checks for accuracy. Special study plots throughout southwestern Montana aid in predicting budworm damage and the study of natural controlling factors.

2. Control — In 1952 aerial spray operations were started on the Bitterroot National Forest. Since then many more forested acres have had control measures applied. The prime purpose of the control programs is to reduce spruce budworm populations to a level that will permit natural control factors to take over. Control work allows the tree to keep its new growth and recover its vigor.

Control of the caterpillar is closely timed to the later stages of development when insecticides are most effective. Although it is virtually impossible to kill every budworm in the forest, a correct, single application of insecticide gives the forest relief from the budworm for 6 years or more.

During this time it is hoped that natural enemies will be able to gain control of the spruce budworm epidemics. Such has been the case in several areas where control measures have been applied to reduce budworm populations.

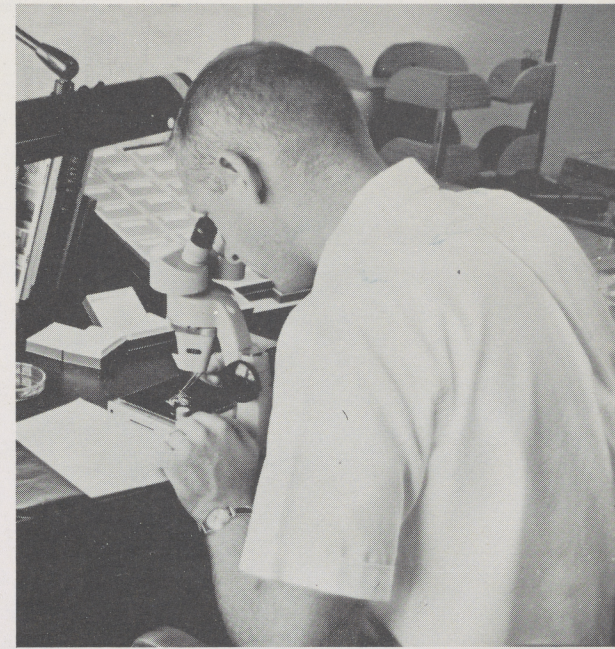
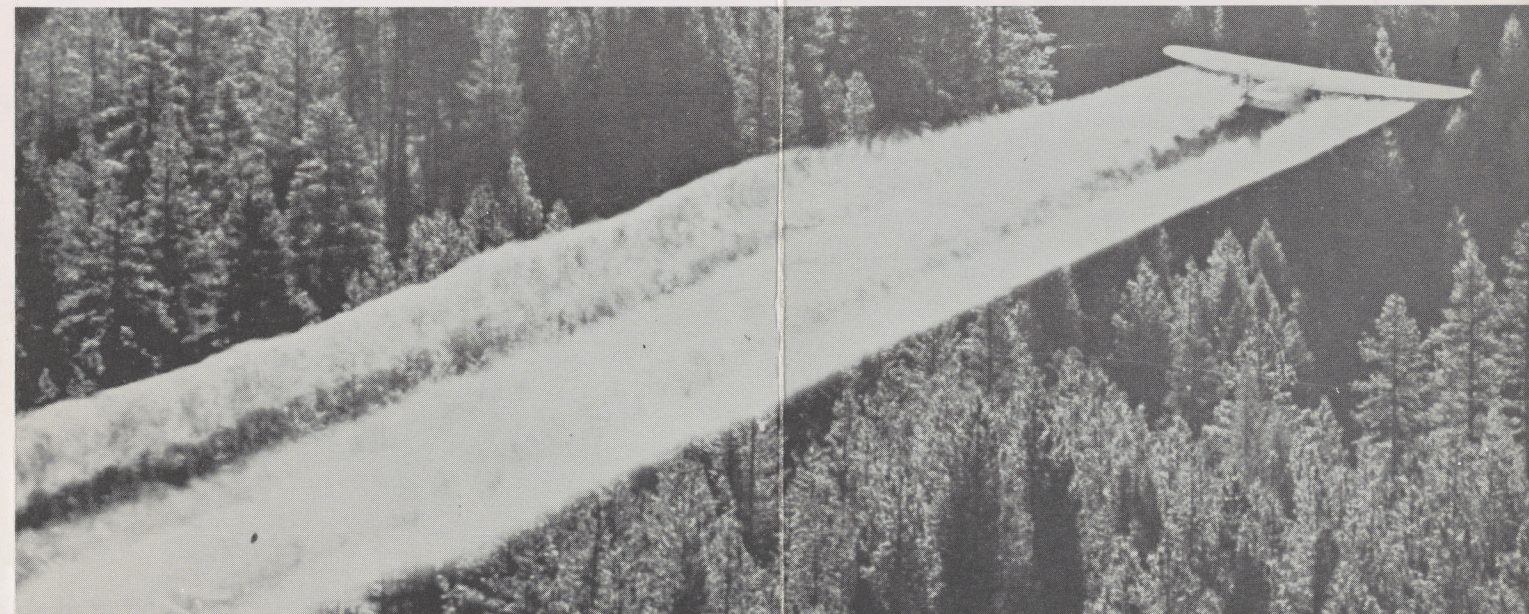
3. Research — The spruce budworm is being carefully studied. New control methods and insecticides are being tested. Natural enemies of the spruce budworm are being sought and tested as possible means of biological control.

Methods of aerial spraying are being improved. The use of helicopters and low-volume spraying is being studied. Through research more efficient control methods have been and will continue to be developed to better safeguard wildlife, fresh water, and forests.

4. Safety to Wildlife — The use of insecticides against spruce budworm may have an effect on other living things. Unsprayed buffer zones are established along all fishing streams and lakes. Controls are constantly being applied to prevent the streams from receiving harmful dosages.

Effects on fish and wildlife are studied by the U. S. Fish and Wildlife Service, Montana State Board of Health, and the Montana Fish and Game Department. Every possible measure is taken to protect fish, wildlife, and trees.

CONTINUED CONTROL IS PLANNED TO PROTECT OUR RESOURCE VALUES



Checking natural damage to egg masses.

and **PLEASE**
make people
more careful



SPRUCE BUDWORM

NO. 1 INSECT ENEMY
OF DOUGLAS-FIR IN MONTANA



U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE/NORTHERN REGION
MISSOULA, MONTANA

WHAT IS IT?

To the entomologist, it is *Choristoneura fumiferana* (Clem.). To the forest worker, it is spruce budworm. It feeds on the needles of spruce and fir trees.

As very small caterpillars, budworms spend the winter under bark scales or any other convenient shelter. In May caterpillars move to find food. If new tree buds haven't begun to grow, caterpillars mine the inside of old needles. Caterpillars usually feed on new foliage until the middle of July. By this time they have grown from the size of a matchhead to about 1 inch in length.

During mid-July, caterpillars lightly web needles together and go into a resting stage. After 10 or 12 days the budworms emerge as moths. The mottled brown moths are about three-fourths of an inch long. Normally, the females are too heavy with eggs to fly far, so most of the eggs are laid on the nearest twig. About 10 days later tiny new caterpillars hatch and make their way to protected areas on the tree. Here cocoons are spun for another winter's rest.

WHY WORRY ABOUT IT?

It is estimated that the spruce budworm has infested approximately 30 billion board feet of timber in Montana. This timber is conservatively valued at \$300 million. Spruce budworm-infested stands contain enough timber to build approximately 3 million average-sized homes.

In some Douglas-fir stands the effect of repeated defoliation has caused considerable tree death. Many areas have trees without much foliage. These areas are unproductive and unsightly. They are prime targets for other insects, diseases, and fires. Recreational areas lose their value without beautiful, healthy trees. Defoliated trees lose their ability to grow and timber production suffers.

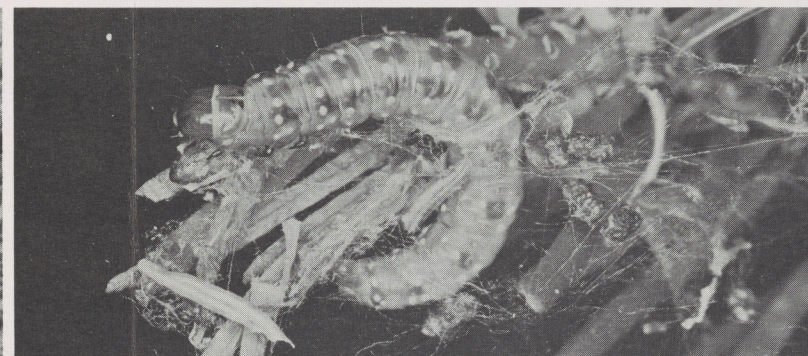
The Christmas tree industry has been wiped out in some areas because of the unsightly foliage left by budworm feeding. Loss of the Douglas-fir stands would leave many barren acres. It would be many years before this land could be reforested.

WHERE DID IT COME FROM - WHAT IS IT DOING?

The spruce budworm is a long-time native of Montana. In early days timber was considered of little value and less attention was paid to budworm destruction. Later, outbreaks were reported but natural causes controlled the budworm before many trees died. Real awareness of spruce budworm has come since 1947, when they became aggressive on millions of acres of forested lands.



Tiny caterpillar, nesting under a bark scale.



Caterpillar feeding on a new bud of Douglas-fir, leaving it without needles.



Hillside of dead, grey trees: aftermath of heavy budworm feeding.

By 1958 over 4½ million acres of Douglas-fir in southwestern Montana were infested. Much work has been done to reduce the damage. Yet, in 1963 aerial surveys revealed visible damage in over 2 million of the 7 million acres of Douglas-fir. Many more acres are infested too lightly to be seen from the air. All indications suggest the spruce budworm will remain an unwelcomed destroyer for years to come. There is no relief in sight.

HOW IT DAMAGES TREES.

In epidemic conditions, spruce budworms kill trees, reduce growth, and produce deformed trees.



After about 4 years of defoliation, tree mortality starts. Tree killing then continues at an accelerated rate. The Douglas-fir tree keeps its needles for from 4 to 7 years before shedding. When budworms eat all the tree's new growth, it means 1 year's fewer needles on the branch. Loss of these needles makes the tree less able to produce food. Shedding the old needles and having the new ones eaten kills the tree. During the period of gradual weakening, trees become an excellent target for other insects and diseases. Douglas-fir seedlings and saplings are killed more quickly than larger and older trees with more foliage.

HOW IT SPREADS.

Spread of spruce budworm infestation is limited mainly to the moth flights. Moths are generally active during the last of July or first part of August. Females first lay most of their eggs on needles where they changed from caterpillar to moth. In the late afternoon and evening, moths fly between and above the trees. During this time, they are sometimes blown across a canyon or over a hill to new areas. Occasionally strong air currents and up-drafts catch the moths and carry them for greater distances. There are reports that these strong winds have transported the budworm moths for distances of 50 miles.